...Journal...

of the

West Australian Natural History Society

with which is incorporated

The Mueller Botanic Society.

No. III.—JULY, 1906.

Perth:
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West Australian Natural History Society.

(With which s incorporated the Mueller Botanic Society).

No. 3.—AUGUST, 1906.

OFFICERS 1906-7.

Patrons:

His Excellency the Governor and Lady Bedford.

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The Right Rev. Dr. Riley, Bishop of Perth.

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Bernard H. Woodward, C.M.Z.S., F.G.S.

Cecil R. P. Andrews, M.A. A. Gibb Maitland, F.G.S

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F. S. Dobbie, 17 Queen-street, Perth.

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Justice McMillan. Alan F. Crossman.

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(With which is incorporated the Mueller Botanic Society).

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List of Publications on Sale.

Mueller Botanic Society—

	Published.	
No. 1	September, 1899 ...	Out of print.
No. 2	October, 1899 ...	3/-
No. 3	November, 1899 ...	Out of print.
No 4	December, 1899 ...	Out of print.
No. 5	January, 1900 ...	Out of print.
No. 6	May, 1900 ...	Out of print.
No. 7	September, 1900 ...	3/
No. 8	December, 1900 ...	1/6
No. 9	January, 1902 ...	3/-
No. 10	December, 1902 ...	1/6
No. 11	April, 1903 ...	1/6

West Australian Natural History Society—

No. 1	May, 1904 ...	1/6
No. 2	May, 1905 ...	1/6
No. 3	June, 1906 ...	1/6

WEST AUSTRALIAN NATURAL HISTORY SOCIETY

(With which is incorporated the Mueller Botanic Society of Western Australia.)

Rules:

1. The Society shall be called "The West Australian Natural History Society," with which is incorporated "The Mueller Botanic Society of Western Australia."

2. The object of the Society shall be the study of Natural History, to be promoted by periodical meetings, conversaziones, field excursions, the formation of a library, and the issue of a journal.

3. The members shall elect (as hereinafter provided) a Council —which shall consist of patrons, a president, three vice-presidents, and seven other persons—to manage the Society's affairs, and at all meetings of Council three shall form a quorum.

4. The members shall elect from the Council an editor or editors of the Journal, and shall elect two auditors.

5. The Council shall appoint, and may remove, a treasurer, a librarian, and a secretary.

6. The ordinary meetings for general business, the reading of papers, and exhibition of specimens, shall be held on the second Monday in each month, unless otherwise determined by the Council.

7. The Society shall consist of (A) Honorary members, (B) Ordinary members, (C) Junior members.

(A) Honorary members, who shall be entitled to all the privileges of ordinary members except that of voting, shall be persons not resident in Perth, who are distinguished for their attainments in Natural History.

(B) Ordinary members shall pay an annual subscription of ten shillings and sixpence, and may become life members on payment of ten guineas in one sum.

(C) Junior members shall be under the age of 16 years, shall not be entitled to vote, and shall pay an annual subscription of five shillings.

8. All subscriptions shall become due on the first day of July in each year, and be payable in advance.

9. Candidates for membership shall be proposed and seconded by members at one monthly meeting, and ballotted for at the next.

10. The Council may remove from the members' roll the name of any who may owe one year's subscription, provided due notice of such intention be given.

11. The Council may remove a member from the Society without assigning any reason therefor at a meeting specially summoned for the purpose, and by a vote of two-thirds of the whole Council. The Secretary shall summon such a meeting on receiving a requisition signed by five members.

12. All the office-bearers and Council shall retire annually, and shall be eligible for re-election at the annual meeting. All elections shall be conducted by ballot.

13. Should any office fall vacant, it shall be filled by the Council. The office of any other member of the Council failing to attend three consecutive Council meetings without any satisfactory reason may be declared vacant. Vacancies from this or any other cause shall be filled up by the Council at their next meeting.

14. The legal ownership of the property of the Society shall be vested in the Council for the time being in trust for the use of the Society, and the Council shall have full control over the use of the funds and management of the property of the Society.

15. The Treasurer shall receive all sums of money due to the Society, pay only such accounts as may be ordered by the Council, keep an account of such receipts and payments, and produce the same when required by the Council.

16. The librarian shall have the custody of all books, instruments, specimens, or other property of the Society, and shall issue the same for the use of the members, subject to such restrictions as the Council may impose.

17. The Secretary shall conduct the correspondence of the Society, attend all meetings, take minutes of the proceedings, keep a register of the names and addresses of all the members, also an account of each person's subscription, issue notices of all meetings of the Society or Council, and otherwise perform the usual secretarial duties.

18. The annual general meeting shall be held in July in each year, and thereat the Council shall submit a report of the proceedings of the past year, and the Treasurer a financial statement duly certified by the two auditors.

19. Should any circumstance arise not provided for in these rules, the Council is hereby empowered to act as may seem to be best for the interests of the Society.

20. Seven ordinary members shall constitute a quorum at a general meeting.

21. The rules can only be altered by a majority of two-thirds of the members present at the annual general meeting or at a special general meeting convened for that purpose. The Council may convene such meeting, and shall do so on receiving a requisition signed by not less than seven members. The proposed alterations and additions must have been submitted to the previous ordinary meeting.

WEST AUSTRALIAN NATURAL HISTORY SOCIETY.

ANNUAL REPORT 1905-6.

MR. PRESIDENT, LADIES AND GENTLEMEN,—

During the year just closed the Society has held nine meetings, and papers on the following subjects have been read :—

"A Visit to the Margaret River Caves," "Peripatus," "Can Plants Feel?" by the President.

"Duboisia Campbelli," Dr. Morrison.

"The Influence of Local Climatic Conditions on Imported Insects," Mr. F. Lowe.

"The Marriage Laws and Class Divisions of the W.A. Aborigines," Mrs. D. M. Bates.

"The Visit of Chas. Fraser, Government Botanist of New South Wales, to the Swan River in 1827," Mr. J. G. Hay.

"Polarised Light and its Application to the Study of Crystals," Mr. J. B. Allen, M.A.

"Demonstrations on Some Parasites of the Blood," Dr. Cleland.

In order to properly illustrate the varied subjects dealt with in lectures, the Society has purchased a Microscope and Polariscope to use with the Museum Lantern; while, to accommodate the books and specimens, a bookcase and cupboard fitted with pigeon holes for the Herbarium has been obtained, at a cost altogether of £45.

The number of members is at present 80, of whom 10 are honorary. While this is less than were on the books 12 months back, the decrease is due to resignations, non-payment of subscriptions, and death. It is, however, satisfactory to note that many new members have recently been admitted, which is a tangible proof that the work of the Society is recognised.

The Government grant of £75 has been continued, and another number of the journal will shortly be issued.

It has been arranged to hold a camp-out in the Stirling Ranges during the coming spring, provided a sufficient number of members send in their names.

F. S. DOBBIE, Secretary.

Statement of Receipts and Expenditure

OF

The West Australian Natural History Society

FOR THE YEAR ENDING 30TH JUNE, 1906.

RECEIPTS.

	£	s.	d.
To **Balance** from last Year	71	15	7
„ **Members' Subscriptions**	24	3	0
„ **Government Subsidy**	75	0	0
„ **Refund** on purchase of Microscope	0	2	10
	£171	1	5

EXPENDITURE.

	£	s.	d.	£	s.	d.
By **Lecture Expenses**—						
Preparing slides for Mrs. Bates' Lecture				1	4	6
„ **Printing**—						
V. K. Jones& Co.	1	7	6			
,, ,, ...	1	12	0			
,, ,, ...	1	16	6			
				4	16	0
„ **Salaries**—						
Secretary, 15 months				18	15	0
„ **Library**—						
Purchase of Books from Mrs. Purdie ...				1	3	0
„ **Petty Cash**						
Postage, Stationery, Attendants, Slides, &c.				16	0	0
„ **Bank Charges**—						
For keeping Account, 10/6, 10/6 ...				1	1	0
„ **Cash in Hand**—				1	1	0
Balance in W.A. Bank				127	0	11
				£171	1	5

We have compared the above Statement of Receipts and Expenditure with the Books and Vouchers produced, and certify the same to be correct.

(Certificate). J. W. LANGSFORD, H. R. COOMBS, } Auditors.

27th July, '06.

FURTHER NOTES ON PERIPATUS.

By Bernard H. Woodward, C.M.Z.S., F.G.S.

At the last meeting, the President stated that when he gave a few notes on *Peripatus* he was unaware that Mr. H. M. Giles, of the Zoological Gardens was the first to discover that animal in Western Australia, in the same locality in which Dr. Michaelsen afterwards found it. Mr. Giles writes:—

"My first find was at Smith's Mill, in a small gully at the back of Hawter's nursery, on October 27th, 1897, when one very fine specimen was taken from under a piece of decaying timber.

"I did not meet with a second specimen until nearly six years afterwards; then I was surprised to find number two, in spirit amongst a lot of insects—spiders, centipedes, etc.—kindly collected for me by Mr. Lance LeSouef, in the Upper Capel River district, on September 17th, 1903.

"The third record was at Mundaring reservoir, on February 26th, 1904, when I saw a very small specimen under a decaying log, but did not take it, on account of its size.

"As far as I can judge, all the above will prove to be the *Peripatus leuchartii* of Fletcher, and identical with the form found in Victoria, New South Wales and Queensland; but, as I have no typical specimen to compare them with, I hesitate to say that it is absolutely that species."

ORCHIDS OCCURRING IN YORK.

By Oswald H. Sargent.

Below is a list of orchids collected by me within five miles of York. Soil and flowering season are given after each name, and in many cases I have added brief notes : —

Thelymitra canaliculata—Ironstone, October. *T. longifolia* — Clayey soil, October. *T antennifera*—Various soils but especially sand, August and September All the flowers I collected in 1905 were strongly and sweetly scented. I have not previously collected scented flowers in the same or any other localities. *T. Villosa*— Sand, October. *T. fusco-lutea*—Sandy soil, October.

Diuris longifolia Common on various soils, August and September. I have collected two or three other species of *Diuris* belonging to the "setacea" group, but I am not satisfied about their identity.

Prasophyllum elatum—Sand, September; I have not myself collected this. *P. cyphochilum* (?)—One specimen only, collected in September last. *P. ovale*—Sand, September. *P. Macrostachyum* — Various soils, August, September, and October; most specimens are very small. *P. hians*—Sand, September.

Microtis media—Marshy places, September and October. *M. alba*—Sand, November.

Pterostylis nana and *P. pyramidalis*—Both these doubtfully distinct forms occur here; typical *nana* flowers in September; it usually occurs in moist sandy soil; a form with more or less rosulate leaves, but a stouter and more hairy plant, with larger flowers than typical *nana*; flowers in June, various soils; typical *pyramidalis* flowers in November; it grows in mud in the riverbed. *P. reflexa* — Various soils, May and June. *P. recurva*—Ironstone, September. *P. turfosa* (rare) Sand, September. *P. vittata*—Ironstone and sand, June. *P. rufa*—Various soils, usually clayey; this plant grows in places soaking-wet in winter and very dry in summer; it flowers in November, the leaves perishing before the flowers open; flowers are almost always green. *P. sargenti*—Light humous soil on ironstone, July and August; the flowering plants have no radical rosette of

leaves at any stage ; the younger non-flowering plants have a rosette of ovate leaves ; there are sometimes five or six flowers in the raceme.

Caleana nigrita —Sand, September.

Drakæa ciliata —Sandy soil, soaking wet in winter and very dry in summer ; the leaf is thick, fleshy, and scarcely complicate when living ; it folds together as it withers and dies, when flowering commences in November. *D. elastica*—Sand, September.

Eriochilus dilatatus—Various soils, April or May ; specimens with four or five flowers on the raceme are common ; I found one in 1905 with thirteen flowers.

Lyperanthus nigricans—Sand, September ; it does not flower every year.

Cyrtostylis reniformis —Moist sandy soil on the shady side of rocks, August and September.

Caladenia menziesii—Damp sandy soil, September. *C. fimbriata* —Sand and ironstone, May. *C. discoidea*—Sand, September ; the calli are closely packed in regular rows, so as to almost form a spathulate plate on the labellum ; flowers are greenish-brown. *C. filamentosa*—Various soils, August and September. *C. dilatata*— Sand, September. *C. patersoni*—I have found two distinct forms : the large white one with long caudæ to sepals and petals (occurs in sand, flowers in September), and a form with yellow perianth and deep crimson labellum (rocky ground, September). *C. hirta*—Sand, September. *C. barbarossæ*—In the bed of the Avon River ; the plants are often under several feet of water in winter ; October and November. *C. flava* —Sand and ironstone, September. *C. latifolia* —Sand, September. *C. deformis*—Various soils, August. *C. gemmata* —Sand, September and October. *C. carnea alba*—Sand, September ; only a few specimens were collected at the end of the flowering season (in 1905) ; they seemed typical ; sepals and petals rusty-grey outside, glistening-white inside ; the flowers were odorless.

Glossodia emarginata—Sandy soil, October and November.

ADDITIONS TO THE FAUNA OF WESTERN AUSTRALIA.

New Species and Sub-species Described during 1905-6.

By Bernard H. Woodward, C.M.Z.S., F.G.S.

MAMMALS.

x *Petrogale lateralis Hacketti* (Thos.)—
Mondrain Island, S.E. Coast. Collector, J. T. Tunney. ("Annals and Magazine of Natural History," page 425, No xciv., October, 1905).

BIRDS.

x *Tadorna radjah rufitergum* (Hartert)—Northern Territory.

Amytornis Woodwardi (Hartert)—Northern Territory.

x *Cracticus quoyi Tunneyi* (Hartert) -Northern Territory.

x *Gymnorhina tibicen longirostris* (Hartert)—Nullagine, W.A.

Pœcilodryas cinereiceps (Hartert)—Derby, N.W.A.

x *Myzomela obscura grisescens* (Hartert)—("Novitates Zooligicæ," pages 192-242, Vol. xii., 1905).

x Signifies new sub-species.

Types or co-types of the above are in the Western Australian Museum and at Tring.

FISH.

The types of the following three new genera and nine species of Western Australian fish are located in the Western Australian Museum. They have been described by Mr. Edgar R. Waite, F.L.S., zoologist in the Australian Museum, Sydney, N.S.W. :—

New Genera.

Neatypus, of the family *Scorpididæ*.

Bramichthys, of the family *Bramidæ*.

Dipulus, of the family *Brotulidæ*.

New Species.

Catulus labiosus (Waite)—Fremantle.

Synodus sageneus (Waite)—Trawled between Fremantle and Abrolhos.

Neatypus obliquus (Waite)—Abrolhos.

Chætodon assarius (Waite)—Fremantle and Abrolhos.

Bramichthys Woodwardi (Waite)—Mandurah.

Cynoglossus Broadhursti (Waite)—Carnarvon.

Dipulus cœcus (Waite) *x*—Fremantle.

Pseudomonacanthus galii (Waite)—Shark's Bay.

Chætodermis Maccullochi (Waite)—Abrolhos.

x Eyes not visible, but the folds and flaps of the membrane of the snout and mandible recall the condition in some of the leaf-nosed bats. The analogy may be very close. The fish is blind, and evidently hunts in the dark by scent.

AN ADDITION TO THE WEST AUSTRALIAN FLORA.

Cecil R. P. Andrews, M.A.

SAMOLUS VALERANDI, Linn.

This plant "is common in most of the temperate and warmer regions of the globe, especially in maritime districts"—Bentham. It is recorded in the "Flora Australiensis" from several localities in New South Wales and from one in Victoria.

I found it in flower at the end of October, 1902—(1) in a swamp between Karridale and the Margaret River; (2) among rushes on the banks of the Margaret River at Wallcliff; (3) in a stream at Yallingup. There can be little doubt that it is a native; it is not sufficiently attractive to lead anyone to introduce it purposely, and it is most improbable that it should have been introduced into three localities in the sparsely-populated district between Capes Naturaliste and Leeuwin.

Like the specimens from the Eastern States, these plants belong to "the smallest-flowered variety, which has been considered by some as a distinct species, and is a common American, but rare European, form."—Bentham.

The plant is known in England as "Brookweed."

NEW SPECIES OF DUBOISIA.

Alex. Morrison, M.D., Government Botanist.

DUBOISIA CAMPBELLI, n. sp.

This plant was collected by Mr. W. D. Campbell in the Eastern Goldfields district, and is distinguished from the other three known species of the genus by the axillary arrangement of the flowers and toothed leaves. It is interesting from having family connections with numerous poisonous plants used in medicine, and specially so from its close relationship to the "pituri" of the aborigines (*Duboisia hopwoodi*), found in this State as well as in the East. This plant is used by them to capture emus and kangaroos by poisoning the water they resort to, as well as for chewing, in which they indulge as Europeans do in the use of tobacco. The active principle of the pituri is almost identical with the deadly nicotine, but the properties of the new species of *Duboisia* have still to be investigated.

The Visit of Mr. *CHARLES FRASER*, Colonial Botanist of New South Wales, with Captain *STIRLING*, in H.M.S. "Success," to the Swan River in 1827, with his Report on the Botany, Soil, and Capabilities of the Locality.

(*Read before the Society by Mr.* J. G. Hay, *20th March, 1906*).

The visit of the Colonial Botanist of New South Wales, with Captain Stirling, in H.M.S. "Success," to the Swan River in 1827 was pregnant with considerable importance, as it was mainly on Mr. Fraser's report that the subsequent settlement was directed.

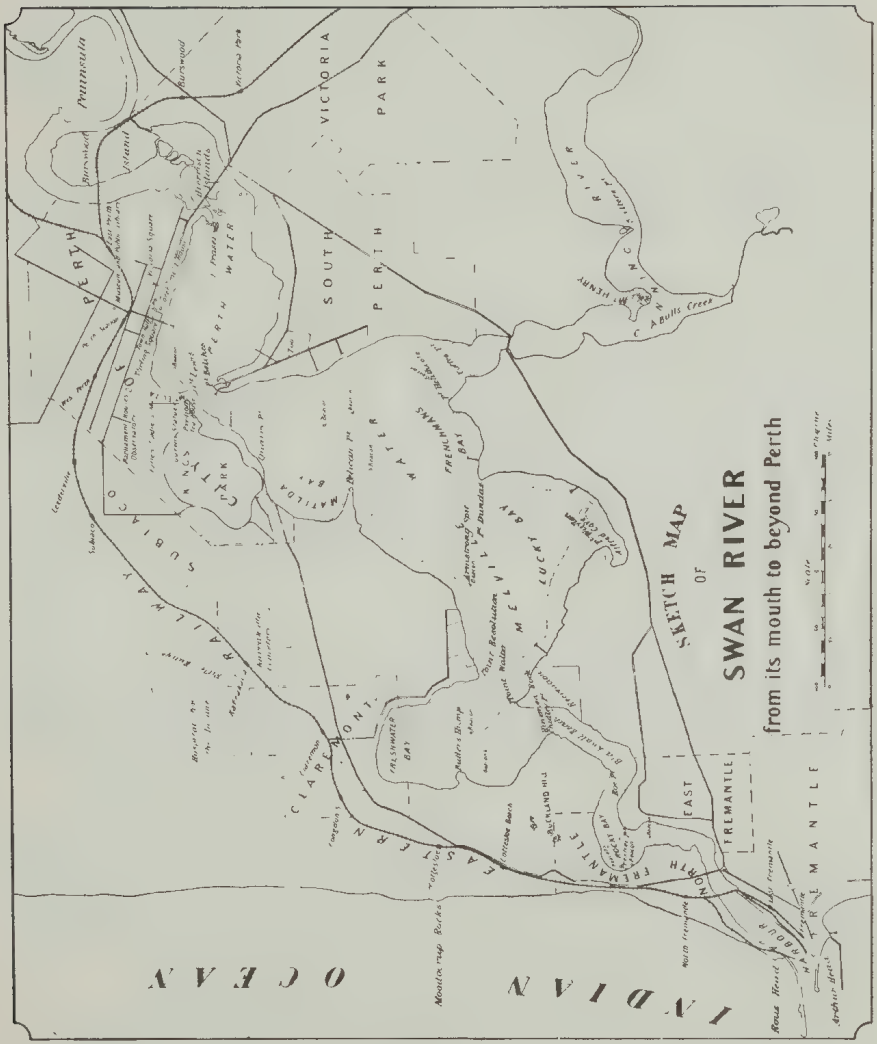
Previously to 1826, the British practically made no claim to Western Australia, being content to allow that portion to remain under the name of New Holland.

If reference be made to Captain Phillip's instructions, it will be seen that he was directed to occupy all that portion of New Holland lying eastward of the 135th degree of longitude; and although, only a few years after, Captain Vancouver (1) took possession (on Michaelmas Day, 1791) of the land he discovered and named King George the Third Sound, yet no occupation of this territory was immediately effected.

It was only after the expedition of 1800–4, ordered by Napoleon (2), had usurped Flinders' discoveries, and named the whole southern coast "Terre Napoléon," and other French ships had visited these

(1.) Captain George Vancouver, with H.M.S. "Discovery" and "Chatham," was on a mission to the north-west coast of America, when, with a crew stricken by dysentery, he made the southern coast, at about Chatham Island, and left it at Termination Island.

(2.) Napoléon's expedition, sent out under the French Republic, consisted of the "Géographe," Commodore Baudin; and the "Naturaliste," Captain Hamelin, who was afterwards sent back to France with despatches; and a second visit to Western Australia made with the "Géographe," accompanied by a schooner bought in New South Wales, and christened by the French the "Casuarina," into which Lieutenant Freycinet was placed in command.


SKETCH MAP
OF
SWAN RIVER
from its mouth to beyond Perth
INDIAN OCEAN
PERTH
SOUTH PERTH
VICTORIA PARK
FREMANTLE
NORTH FREMANTLE
EAST FREMANTLE
CLAREMONT
SUBIACO
MELVILLE
Bulls Creek
Mouillon rge Rocks

shores, that the British authorities, being alarmed, at last directed the occupation of King George's Sound, which was accordingly carried out on Christmas Day, 1826 (3).

Following this event, the Governor of New South Wales directed Captain Stirling to take the Colonial Botanist with him, for the purpose of reporting on the suitableness of the Swan River neighborhood for a settlement.

The "Success," leaving Sydney on January 17, 1827, was accompanied by a cutter, named the "Currency," intended to be employed in coast survey, but which, meeting with mishaps, had to return to Port Jackson.

After a preliminary visit to Hobart, the "Success" arrived off Rottnest on the 5th of March, 1827; and, three days after, the ship's gig and cutter entered the Swan River for the purpose "of examining the banks, the depth of water, to fix on an eligible spot for a settlement, to ascertain the productions of the country, the nature of the soil, and the practicability of shipping." Considering the short time occupied in all this work (not a month in the whole territory), it can scarcely be said that anything like an exhaustive examination of the country was made, and certainly not one that would justify the laudatory terms that were afterwards used to attract the settlers.

The report on which the colony was founded is not in the possession of the State, but a copy of a semi-official journal kept by Mr. Augustus H. Gilbert (clerk of the "Success") is preserved; and from a paper compiled on the botany of the Swan River, etc., by Mr. Charles Fraser, for his friend Dr. Hooker, and published in the first volume of the "Botanical Miscellany," in 1830, we learn much of the prevailing flora seen by the visitors.

Some slight mistakes were made such as calling the Red Gum (*Eucalyptus calophylla*) *Angophora;* but, taken in all, the description of a totally different series of shrubs to those common on the Eastern Coast of Australia, may be called fairly accurate. Mr. Fraser, in the course of his paper, says:

"The soil on the South Head is a barren sand, producing a considerable variety of interesting plants, amongst which I observed

(3.) General Darling sent Major Lockyer from Sydney, with a detachment of the 39th Regiment and a party of convicts, to King George Sound, numbering in all about 70 persons. They landed 25th December, 1826.

Anigozanthus Rufus, *Anthocercis littorea*, two species of *Metrosideros* (4); a charming species of *Prostanthera* (5), producing large quantities of rich blue flowers; a species of *Gnaphalium* (6), with procumbent stems, the white flowers of which give a snowy appearance to many parts of the cliffs; and a beautiful species of *Dryandra* (7). The appearance of the *Gnaphalium* above mentioned is in some measure confirmatory of the sandy character which the French give of these hills.

"On tracing the river a quarter of a mile from its entrance, on the south bank (8), I observed quantities of a species of *Brunonia* (9), growing in great luxuriance on the margin of a salt marsh, its flowers of a brilliant sky-blue. Here I likewise gathered a magnificent species of *Melaleuca*, with scarlet flowers (10), and two species of *Metrosideros*, with various other plants, which, from their being neither in flower nor in fruit, I could not attempt to describe.

"Half a mile from the entrance, I found the soil, although apparently sterile, to consist of a fine light-brown loam, containing a small proportion of sand, and capable of producing any description of light garden crop. This character not only applies to the immediate bank as far as the reach (11) below Pelican Point (12), but likewise to the hills as far as my observation led. These hills present the appearance of a petrified forest (13), from the immense quantity of trunks which protrude for several feet above the surface;

(4.) Dr. A. Morrison, the Government Botanist, to whom I am indebted for these botanical notes, says:—"*Metrosideros*, at the time Fraser wrote, was a name applied to a great variety of myrtaceous plants, now known under the genera *Melaleuca*, *Kunzea*, *Callistemon*, *Angophora*, *Eucalyptus*, *Syncarpia*, and *Exanthostemon*. Probably he referred to paper-bark trees.

(5.) Most likely *Hemiandra pungens*.

(6.) *Calocephalus Brownii*.

(7.) *Dryandra floribunda* probably, a shrub or small tree.

(8.) The position of Phillimore-street, Fremantle.

(9.) Probably *Dampiera Linearis*.

(10.) More than one such.

(11.) Blackwall Reach.

(12.) Pelican Point. This is evidently intended for Point Walter. Fraser wrote this paper in Sydney, two years after his visit, and a number of errors principally small, occur in its pages.

(13.) The petrified appearance may be observed at several localities, notably at Cottesloe, Mount Eliza, and Arthur's Head. It is due to the shrubs and small trees being buried by drifting sand, then calcified by the lime (dissolved out of the sand by the rains) taking the place of their decaying tissues.

their decomposed state renders them of benefit rather than otherwise to the soil. Here I observed a brown snake, similar to that of Port Jackson, and it is remarkable that this was the only snake seen during the survey (14).

"At the distance of one mile from the mouth of the river (15), the genus *Eucalyptus* appears, although in a stunted state. I was much astonished at the beautiful dark-green and vigorous appearance of the trees, considering that the season had been evidently unusually dry; but the cause must arise from the great quantity of springs with which this country abounds. On penetrating two feet into the earth, I found the soil perfectly moist, and I feel confident that, had I penetrated a foot deeper, I should have found water. On the beach I observed several small pools of water and many moist spots, which, in seasons of unusual humidity, must be the seat of active springs issuing from the calcareous rocks that bound them. The luxuriance of the vegetation on the immediate beach is truly astonishing. It consists principally of syngenesious plants, and a species of *Hibiscus* with peltate leaves (16). Here I observed a beautiful pendulous *Leptospermum*, resembling in its appearance, and the situation which it prefers, the weeping willow (17). An arborescent species of *Acacia* (18) was likewise seen associated with it.

"While examining the productions of a mass of cavernous limestone rocks on the beach, I was astonished by observing an extensive spring issue from beneath them, in width about 7 feet, running at the rate of 3 feet in a second. The water was brackish, but it is evidently fresh at some periods of the tide. Its elevation is about 3 feet above low-water mark, yet at its lowest ebb its current was at the above rate The water was found, on being analysed, to be of the same quality as that at Harrowgate (19).

(14.) Snakes. On the occasion of the French visit in June, 1801, the report states:—"Snakes are common enough on Rottnest Island. Many are not less than 4ft. to 5ft. long. with a diameter of 1½in. to 2in. Their color is greyish, but we did not observe if they were venomous." This was probably the brown snake (*Diemenia superciliosa*), the color of which varies. It may be presumed that they would also be on the mainland, as brown, black, and brown-banded are to be obtained about Perth to this day, though not so numerous as in the Eastern States.

(15.) This would be the position of the present railway bridge crossing the river at Fremantle.

(16.) *Hibiscus Huegelii*, but leaves not "peltate."

(17.) *Agonis flexuosa*. The peppermint tree.

(18.) *Acacia cyanophylla*.

(19.) This mineral spring would be about the position of the Port Brewery, near the railway bridge; but the water is not similar to Harrogate.

"The soil on the North Head is sandy; its productions much the same as that of the south Two hundred yards from the beach the soil changes to a light-red loam, improving, as the hills ascended, to that of a fine virgin earth (20). The valleys separating these hills along the coast are of the richest description, as far as my observations led, and inland extending to Pelican Point (21), beyond which their character was not ascertained. These hills (22) are admirably adapted for the site of a town, their elevated situation commanding a view of the whole of Canning Sound (23), with the adjacent coast, the interior for some distance, and the meanderings of the river. Their lying open to all breezes, too, is an additional advantage.

"The limestone with which these hills are studded renders them admirably adapted for the production of the vine; and, as they are free from timber and brushwood, they may at once be brought into a state of cultivation.

(20.) This very fulsome account was not borne out by Captain Fremantle, R.N., who, in a despatch to the Admiralty, dated 8th October, 1829, said:—"The soil of the sea coast was generally sandy; but on arriving at the fresh water in the Swan and Canning rivers the banks were rich, and the soil capable of producing anything." Vlaming's description of the same spot, visited on the 5th January, 1697, is still more pithy. The Dutchman says:—"As regards the country it is sandy, and in the place where we were had been planted with a good many shrubs, among which were some quite three and four fathoms (vademen) thick, but bearing no fruit, in short, full of prickles and thorns. Several of these yielded gum nearly like wax, of a brownish-red color."

(21.) Now known as Crawley Point.

(22.) These hills are Buckland Hill and those in the neighborhood, but the evident intention of fixing a town there was abandoned by Captain Stirling in 1829, for the provision of two towns, as mentioned in Captain Fremantle's despatch of 8th October, 1829: "The Lieutenant-Governor had fixed on a site for a town about 12 miles up the Swan River, on the right bank, just below the islands, where he intended removing to immediately with the whole of the party landed on Garden Island. The town is to be called Perth. There is also another town to be built, at the mouth of the river, for the convenience of the shipping in Gage Roads, near the spot where the party from the ship first established themselves" The capital, Perth, was so named after the birthplace of Sir George Murray, the Secretary of State for the Colonies, who had granted Stirling's request of giving him Garden Island, and 90,000 acres besides, for his visit to the Swan River in 1827. The seaport town was called after Captain Fremantle, R.N., of H.M.S. "Challenger," who arrived at the mouth of the Swan River on 2nd May, 1829, and hoisting the British flag on the South Head, took formal possession, in the name of His Majesty King George IV., of all that part of New Holland which is not included within the territory of New South Wales. Exactly one month after, Captain Stirling arrived with the first settlers in the hired transport "Parmelia."

(23.) Canning Sound, in 1827, gave place, in 1829, to Gage Roads and Cockburn Sound.

"The trees and shrubs seen on these hills consisted of stunted *Eucalypti* and *Leptosperma*, and a beautiful species of *Calytris*, or *Cyprus*, of the finest green color, producing large warted cones.

"On traversing the beach, I was agreeably surprised at the great degree of fragrance imparted by two graceful species of *Metrosideros*, then in flower, which exceeded anything I ever experienced. On the beach I observed a magnificent arborescent species of *Rhagodia* (25), 20 feet in height, immense quantities of *Gnaphalium*, two species of *Helichrysum* (26), and a beautiful species of an unknown plant. There were no marine productions observed upon the shore (27).

"From Pelican Point (28) to the entrance of the Moreau the country is diversified with hills of gentle elevation and with narrow valleys, magnificently clothed with trees of the richest green. Here the genus *Banksia* appears in all its grandeur, consisting of three species, of which *B. grandis* is the most conspicuous (29). The principal timber is *Eucalyptus*. The shrubs consist of a species of *Dryandra*, two species of *Hakea*, one of *Grevillea* (30), and a pendulous species of *Viminaria* (31) of considerable height, richly clothed with yellow and crimson flowers, associating itself in the most graceful manner with the weeping *Leptospermum* formerly alluded to. *Xanthorrhœa Hastilis* (32) is abundant, as is *Zamia spiralis* (33),

(24.) *Calytris. Callitris robusta.*

(25.) *Rhagodia*, 20ft. high, may have been *Rhagodia Billardieri*, common also on the south-eastern coasts.

(26.) *Helichrysum cordatum.*

(27.) The French said: "The beach was covered with a very large number of gelatinous and transparent white molluscs, abandoned by the tide, and which are doubtless the food of the birds frequenting these shores."

(28.) Pelican Point, now known as Crawley, is opposite the entrance of the Canning River, and Fraser again, no doubt, means Point Walter, on the same side as the Canning.

(29.) *Banksias.* The three commonest are *B. grandis*, *B. Menziesii*, and *B. attenuata.*

(30.) *Dryandra*, *Hakea*, *Grevillea.* More than one species of each found in the neighborhood.

(31.) *Viminaria denudata.* Same as in the East.

(32.) *Xanthorrhœa Preissii*, not *Hastilis.*

(33.) *Zamia spiralis.* The western plant was found afterwards to be a distinct species, and was named by Miguel *Macrozamia* (or *Encephalartos*) *Fraseri*, after Fraser himself.

while *Anthocercis littorea* is seen to attain a height of 10 feet. The shores are covered with rushes of great height and thickness, concealing many beautiful syngenesious plants, but they are occasionally flooded. Here I observed the common *Casuarina* (34) of Port Jackson, though with a stunted habit. These beds of rushes are probably the rendezvous of the dugong, mentioned by Mons. Péron, but of which we saw none (35).

"On examining the shoal water of Pelican Point, I observed an aquatic stoloniferous species of *Goodenia*, with which the sandy bottom is covered.

"The soil between the above points resembles, in its surface, the sandy soil of the shores of Port Jackson more than any hitherto seen; but, on digging a few inches, it is found to contain a considerable proportion of loam. The valleys and headlands furnish an excellent soil, more particularly that of Garden Point (36) Here we planted several bananas, and seeds of all sorts of culinary vegetables. This point produces an immense quantity of herbaceous plants, amongst which I observed a pulverulent species of *Goodenia* and a species of *Centaurea*.

"The botany of Point Heathcote (37) is splendid, consisting of magnificent *Banksias* and *Dryandras*, a remarkable species of *Hakea*,

(34.) *Casuarina*. If the same shrubby species as that common at Port Jackson, it would be *Casuarina distyla*.

(35.) On the return of the French boating expedition from exploring the Swan River, the party was for 13 hours up to the waist in slime and water, dragging the boat over the mud-flats at Heinsson's Islands, in cold and rain. The following graphic account was given by Mons Bailly :—"In the midst of all these troubles and dangers, which had come upon us without ceasing, night descended. We were preparing to get ashore to dry ourselves and restore our spent vigor, when all of a sudden a terrible howl freezed us with terror. It resembled the bellowing of an ox, but much louder, and appeared to come out of the neighboring reeds." This occurred at what is now the foot of Plain or Bennett streets, and was not ascribed by name to any animal. May it have been the sea lion or sea bear, *Arctocephalus* (or *Otaria*) *Forsteri*, which has been known to frequent reeds for a lair? Probably the animal was as much frightened as the French.

(36.) Garden Point. This is now known as Point Lewis on the maps, and is the present termination of the Mount's Bay-road tramline. The banana groves existing in this locality are the product of the plants placed there by Fraser. A second garden was also planted, probably at the site of the present gardens, which Stirling named, after himself, Stirling Square. These take the place of botanic gardens elsewhere.

(37.) Point Heathcote is the Eastern Cape of Frenchman's Bay, about a quarter of a mile north-west of what is known now as Coffee Point.

two species of *Grevillea*, a species of *Leptospermum*, and a beautiful dwarf species of *Calytris*. Here we came to great abundance of fresh water on the beach, by scratching the sand with our fingers, within 2 inches of low-water mark. The beach at Garden Point is of the same character, and I doubt not but within the heads will be found of the same description. This was afterwards found to be the case, not only on the river, but on the beaches of the islands of Buâche and of Berthollet (38).

"The view from Pelican Point (39) is exceedingly grand. The contrast between the dark blue of the distant mountains and the vivid green of the surrounding forests is such as must in a peculiar manner strike the attention of a person long accustomed to the monotonous brown of the vegetation of Port Jackson. It is, indeed, materially different from anything I have yet seen in New South Wales.

"From Point Heathcote to the islands (40) the country seems to improve, as far as I could judge from the immense quantity of herbage it produced.

"Point Belches (41) on the opposite shore, the only spot on that shore examined, was found to produce *Banksias* and *Eucalyptus*. The shrubs consisted of a beautiful *Isopogon*, a species of *Acacia*, and a *Jacksonia* with crimson flowers (42), together with the general productions of the opposite shore. The soil is sandy. The cliffs (43)—of very considerable elevation on the northern shore, are formed of fossil-limestone and sandstone. The view from this point of the meanderings of the river and the Moreau (44), with the

(38) A garden was planted on Buâche, and Stirling, in 1829, changed its name to Garden Island. In like manner he called Berthollet "Carnac," after one of his lieutenants. The whole group was called "Isles Louis Napoleon" by the French in 1801.

(39.) Pelican Point, now known as Crawley, is a long sandspit, and the reference of Fraser more accords with Point Walter (named after Stirling's uncle, Sir Walter Stirling) than with any other. Point Walter has a fairly high ridge, commanding a good view.

(40.) Heirisson's Islands, named after the midshipman in charge of the French boating party who explored the river.

(41.) Point Belches is the extreme northern point of South Perth, or what was afterwards called Mill Point, at the Narrows. It was named after Lieut. Belches, of H.M.S. "Success."

(42.) *Jacksonia furcillata*.

(43.) Mount Eliza; so named, in 1827, by Stirling, after Lady Darling, the wife of the Governor of New South Wales.

(44.) The French did not explore the Canning River, but named its entrance "Entrée Moreau." They at first set it down as being another communication with the sea. Stirling, in 1829, named the tributary river after Canning, the Prime Minister of England.

surrounding country and distant mountains, is particularly grand (45). This seems to be the extreme easterly boundary of the limestone (46).

"The islands (47) on the flats are composed of a rich deposit carried down by the floods. Their margins are covered with *Metrosideros* and *Casuarina* (48), and their interior with seaside succulent plants. On one side of these islands I caught sight of a plant with an arborescent habit, which, on examination, proved to be a species of *Zamia* with spiral fruit, differing only from *Z. spiralis* in habit. Here the equatorial *Goodenia*, formerly alluded to, disappears. The difficully (49) which the party now experienced from having mistaken the channel, and in having, consequently, to drag the boats over the mud, were great, but by perseverance were overcome. From the extensive beds of oyster shells (50) which lie a foot deep in the soft mud, our feet became dreadfully lacerated. These flats are extensive, but by employing flat-bottomed boats they may be easily crossed (51).

"At Point Fraser (52) the bank may be said to terminate, and the channel appears to be that of a beautiful inland river. From the entrance to this spot it may more properly be called an estuary. The flats, or levels, at this spot are very fertile, composed of a rich alluvial deposit, but evidently occasionally flooded, drift timber having been seen 5 feet above the surface. Here are extensive salt-marshes,

(45.) The view from the King's Park, on Mount Eliza, is the finest of its kind in all Australia. In no other city is there such a combination of city, suburb, and river, backed by a mountain range. It certainly is a view that no visitor should miss.

(46.) This has since been found not correct.

(47.) These islands (Heinisson's) it is intended one day to convert into recreation gardens. One of them has already been chosen by some of the black swans for a nesting ground. These swans were obtained from other localities under Sir John Forrest's administration, and after a little nursing at the Mill Pond, South Perth, were liberated on the river. They are now again thoroughly at home on the river named after them, by Vlaming, on the 5th of January, 1697.

(48) *Casuarina glauca*.

(49.) The French, with one boat, had a greater difficulty; whereas the English party had two boats, and consequently a greater number of hands.

(50.) These shells make excellent footpaths in Perth.

(51.) A canal was cut through the isthmus of Burswood Island in 1830, and a dam constructed to divert the water in such a manner as to keep open a channel. This canal has long since been allowed to close up, and barges and boats have to make the circuitous course round the three sides of this so called island. Another canal, some years ago, was cut through the mud-flats, and is still used.

(52.) Point Fraser (named after the Colonial Botanist of New South Wales) is the south-eastern extremity of the City of Perth. The Swan River here takes a northerly sweep.

admirably adapted to the growth of cotton (53). This has already been produced at Sydney, and pronounced by the ablest judges in Britain to be of very superior quality. There can be no question but that, both as to soil and climate, the banks of the Swan River would prove better adapted to the cultivation of this plant than Port Jackson, and the seed that should be tried is that of Sea Island Cotton.

"The hills on the bank of the river are exceedingly barren, resembling those of Port Jackson, but producing a magnificent species of *Angophora* (54), which seems to assume the same situation in the botany as the genus *Eucalyptus* does in that of Port Jackson. *Banksia grandis* was here seen to attain the height of fifty feet, and its trunk frequently exceeded two feet and a half in diameter.

"Amongst the new botany of this tract may be enumerated a species of *Metrosideros* of great elegance, forming thickets on the flats, and intermingling with two other species of the same genus, but of less beauty; its flowers of the most brilliant scarlet (55); the general height of the tree, 6 feet. There were also a pink flowered handsome species of *Centaurea*, a remarkable dwarf species of *Hakea*, two species of *Daviesia* and *Dryanda Armata*.

"I observed a species of *Psittacus* (56), in large flocks, whose

(53.) The cultivation of cotton at the close of the eighteenth century was enthusiastically taken up by one Baron De La Clampe, a retired French officer of the ancient *regime*, who after serving in India against the English, and being taken prisoner, desired to emigrate to New South Wales rather than join the army of the French Revolutionists. Mons. De La Clampe's plantation at Castle Hill, in New South Wales, was visited by Mons. Péron in 1802, and fine specimens, similar to Nanking cotton were then inspected.

(54.) *Eucalyptus calophylla*, the red gum of Western Australia. An excusable mistake by Fraser, as a strong resemblance exists to the apple-tree gums of New South Wales.

(55.) *Metrosideros*, with flowers of a brilliant scarlet, would be probably either *Melaleuca laterifea* or *Beaufortia squarrosa*.

(56.) *Psittacus*. Mr. A. W. Milligan, the Western Australian ornithologist, says:—"The ground-feeding cockatoo I take to be *Cacatua Leadbeateri*, or Leadbeater's cockatoo. It is possible, however, that it may be *Licmetis nasica* (commonly known as the corella), which also feeds upon and digs into the ground." On referring to Gould, that celebrated ornithologist says: "*Cacatua Leadbeateri*. The pink cockatoo of the colonists of Swan River. This beautiful species of cockatoo enjoys a wide range over the southern portions of the Australian continent. It never approaches very near the sea, but evinces a decided preference to the interior of the country. It annually visits the Toodvay district of Western Australia, and breeds at Gawler, in South Australia." Of *Licmetis* he says:—"*Licmetis nasicus*. The habitat of the present species would appear to be confined to Victoria and South Australia, where it inhabits the interior rather than the neighbourhood of the coast. Like the *Cacatua galerita* (great sulphur-crested cockatoo), it assembles in large flocks, and spends much of its time on the ground, where it grubs up the roots of orchids and other bulbous plants, upon which it mainly subsists, and hence the necessity for its singularly-formed bill." And of the other species he says:—"*Licmetis pastinator*. Western long-billed cockatoo. All ornithologists now admit that there are two species of the genus *Licmetis*, one inhabiting the western and the other the eastern portions of Australia."

voice is more plaintive than that of the white cockatoo. It feeds on the roots of orchideous plants, to obtain which it scratches the ground to a considerable depth.

"While attending to a boat in the river, which the party was dragging over the mud, I distinctly heard the bellowing of some huge animal, similar to that of an ox, proceeding from an extensive marsh further up the river (57). (Could this be the dugong of the French?)

"Immediately afterwards, I was visited by three natives, armed; they made signs for me to depart, but offered no violence. On hearing the voices of the party they retired in the woods.

"One mile up the river from the last point is a small creek (58) of fresh water, issuing from an extensive lagoon clothed with arborescent species of *Metrosideros* of great beauty. The banks are covered with the most interesting plants, amongst which I observed two species of *Calytris*, a species of *Acacia* (59) with a scolopendrous stem, and several *Papilionaceous* plants. The *Angophoras* on the flats are gigantic. These flats are formed of tolerable loam, of great depth, and capable of producing fair crops.

"The *Zamia* seen from the islands was here observed to attain the height of 30 feet. *Xanthorrhœa arborea*, too, was of equal size, and, associated with the splendid *Banksias*, imparted to the forest a character perfectly tropical.

"I was astonished at observing the facility with which water was obtained in this apparently sterile tract, for on digging to a depth of 3 feet it was found in abundance, and of the best quality.

"Proceeding up the river from the above-mentioned creek, the country assumes a distinct appearance from that seen below. On the left is an extensive marsh (60), bordered by thickets of *Casuarina*, surrounded by a flat of the richest description, rivalling in point of soil that of the Hawkesbury. Here I first observed the *Brome*, or kangaroo-grass of New South Wales, in great luxuriance (with the exception of some seen on the banks at Point Fraser). Bastard and blue gum (61) is seen here in considerable quantities and of great size. The opposite bank is high, and covered with *Eucalyptus* and *Banksia*. The soil is a light sandy loam.

(57.) This would not be very far from the lair of the animal that so startled Mons. Heirisson's party in 1801.

(58.) Claise Brook. Now the main sewer of Perth, the site of the septic-tank treatment of sewage.

(59.) *Acacia diptera*.

(60.) Walter's Brook, named by Stirling after his uncle. This is now the city boundary, dividing Perth from Maylands.

(61.) May refer to the flooded gums of this State.

"From the above point the country resembles in its features that which borders all the rivers of New South Wales the course of which is west of the Blue Mountains, varying alternately on each bank into hilly points and extensive flats. The hills are covered with magnificent *Angophoras*, *Zamias*, and *Xanthorrhœa*. The soil is a rich red loam of very great depth, throwing up a luxuriant herbage, amongst which I observed *Anigozanthus rufus*, *Clematis aristata*, and a beautiful species of *Borya (?)* The flats, which are composed of the richest brown loam, equal to any on the east, are thinly studded with gigantic blue gums, and occasional stripes of suffrutescent *Acacias* and papilionaceous shrubs, occupying in this country the same situation in the geography of its botany as the green wattle in New South Wales. *Banksia* and *Zamia* are still seen on the high ands.

"It is worthy of remark that, in New South Wales, the presence of *Banksia*, *Zamia*, *and Xanthorrhœa* are considered sure criterions of a bad soil; and, such being the impression on my mind, I pronounced all the land on which they were seen to grow to be sterile, until I examined a ridge on the banks, producing them in great luxuriance, when, to my astonishment, I found the soil to be a red earth of great depth, producing the most luxuriant *Brome* grass.

"In proportion, as we ascend the river, the flats increase in breadth and luxuriance, each being backed by a terrace of forest land of the finest description, extending for miles from the river, and resembling in character those seen on the banks of the Macquarie River, west of Wellington Valley. On further observation, towards the source of the river, these flats were seen to extend to the base of the mountains, interspersed with stripes of good forest land, on which I observed a considerable portion of stringy bark (62). The variety of plants seen on this tract was great; amongst the new ones I observed I may enumerate seven species of *Hakea*, a species of *Lambertia* (63), four species of *Isopogon*, three species of *Leptospermum*, a species of *Petrophila*, and a liliaceous plant not seen in flower. *Banksia grandis* was remarked in a stunted state.

"The base of the mountains (which was named Darling's Range, in honor of General Darling) is covered with fragments of quartz and chalcedony. The soil is a red sandy loam. Here I observed a species of *Hakea* with holly-shaped leaves (64). Further up the soil improves to a light-brown loam, but, from its rocky nature,

(62.) No stringy bark exists, but this would refer to the jarrah (*Eucalyptus marginata*).

(63.) *Lambertia multiflora*, with yellow flowers.

(64.) *Hakea* with holly-shaped leaves would be either *H. glabella*, *cristata*, or *amplexicaulis*.

is incapable of cultivation. I saw a beautiful species of *Dryandra*, and a species of *Hakea* and several syngenesious plants. The summit of the mountain is studded with noble *Angophoras*. Here, too, I found a beautiful species of *Arthropodium* (65) with filiform leaves, an arborescent species of *Hakea* (66), a species of *Dryandra*, and two species of *Isopogon*. The view from this summit is extensive, resembling that seen from Princess Charlotte's Valley, which I witnessed in 1817 (67) *vide* Oxley's Journal –but divested of the permanent swamps. The highest part of the range is of ironstone, but it is remarkable that there is no underwood. The ranges are of equal height, so that no view could be had to the eastward.

"At the source of the river I observed thickets of an arborescent species of *Acacia*, and gigantic thistles (67) 11 feet in height. Here I found a magnificent species of *Hibiscus* (69) with brilliant sky-blue flowers, and a species of *Euphorbia* (70). The ridges on the banks are perforated with immense numbers of deep pits, the origin or cause of which we could not at first ascertain. They proved to be made by the natives for the purpose of catching land tortoises, with which these ridges abound.

"We found the river to be navigable until it almost ceases to be a stream, or where there is not room for a boat to pass (71). The water is fresh 16 miles below its navigable source, and that at the end of a very dry season; what, therefore, must it be in the wet season? (72). Mons. Freycinet (73) states that he found no fresh water, although he was in the country during the rains, a decisive proof that we must have penetrated at least 25 miles higher than he did. We saw nothing of the lake (74) laid down by him, and judge it to be a

(65.) *Arthropodium Preissii*.

(66.) *Hakea glabella*.

(67.) Fraser was formerly a private soldier in the army, and Oxley alludes to him as "Fraser, our soldier-botanist."

(68.) These thistles must have been introduced, probably by the French in their exploration of the Swan.

(69.) May be *Hibiscus hakeaefolius*.

(70.) *Euphorbia*. May refer to *Phyllanthus calcinus*, which is quite a common *Euphorbiaceous* plant.

(71.) The furthest portion of the Swan shown on Stirling's map is its junction with Ellen's Brook (named after his wife). The river now is navigable beyond this.

72. This is extraordinary, as that part of the river shown by Stirling as "river-water fresh here" would scarcely be as far as the present site of Guildford, where it is only fresh with the winter rains.

(73.) There is no mention in Péron's Journal of Mons. Freycinet (who was a lieutenant) being in Midshipman Heirisson's boat.

(74.) The French, on their map, showed a "pond" of fresh water on the west side of the river, close to its bank, at the termination of their survey. This would be about the site of Guildford.

swamp. The supply of water from underground springs into the river must be immense, for it is impossible that the springs at the source could furnish such a quantity of fresh water (75). The tide at the entrance of the Swan River was not observed to rise above 2 feet, even at spring tides and at the source it was hardly observable.

"The climate during our stay was the most delightful I ever experienced, the thermometer seldom ranging above 85deg.; the nights agreeably cool. The sea breezes set in at two hours after sunrise, and cease at sunset, when they are immediately succeeded by the land breeze, which, even in February (76), is so agreeable that, while surveying the river, we preferred sleeping in the open air to lodging in tents.

"The quantity of black swans (77), pelicans, ducks, and aquatic birds seen on the river was truly astonishing. Without any exaggeration, I have seen a number of black swans which could not be

(75.) The river has a much longer course than was suspected for many years. It may be said to rise some distance to the east of Pingelly, and taking a northerly course flows through Beverley, York, Northam, and Newcastle, under the name of the Avon; from Toodyay it takes a westerly course, through the Darling Range, down to Guildford, etc.

(76.) This is a serious mistake by Fraser, as the English party visited the Swan River in March, 1827 not February, as stated. The summer ends in March, while the temperature in February is the hottest in the year. The exact dates are as follow: January 17: H.M.S. "Success" sailed from Sydney, and on the 27th anchored in the Derwent, in Van Diemen's Land. February 8: Left the Derwent, and on March 5 arrived off Rottnest Island. March 8: The first gig and cutter entered the Swan River, which was examined by the 14th; and, after another day spent by the gig in exploring the Moreau (Canning River), the remainder of the time, to March 20, was employed in surveying the islands of Rottnest, Buache, and Berthollet. March 21: Stood to sea, and after examining Geographe Bay and Cape Naturaliste, anchored at King George Sound on April 2. April 4: Stood to sea, with a strong breeze from the S.W., and at 10 p.m. on the 15th anchored at Port Jackson.

(77.) The black swan (*Chenopis atrata*) is not a true swan, but an allied form. It was first observed by Vlaming on January 5, 1697, when he named the river after them. It is not, however, exclusively confined to this part of Australia. These birds were nearly exterminated from the river, but having been obtained from other places are now again seen upon the waters of the Swan. Gould says:—"Our celebrated countryman and navigator, Cook, observed it on several parts of the coast. I may state that the black swan is generally distributed over the whole of the southern portion of Australia, the islands in Bass' Straits, and the still more southern country of Tasmania, wherever there are rivers, estuaries of the sea, lagoons, and pools of water of any extent. In some instances it occurs in such numbers that flocks of many hundreds may be seen together, particularly on those arms of the sea which after passing the beach-line of the coast expand into great sheets of shallow water, on which the birds are seldom disturbed either by the force of boisterous winds or the intrusions of the natives. In the white man, however, the black swan finds an enemy so deadly that in many parts, where it was formerly numerous, it has been almost, if not entirely, extirpated." Of pelicans, the only species found in the State (*Pelecanus conspicillatus*) is still to be seen on the river while ducks frequent its reaches above Heirisson's Islands.

estimated at less than 500 rise at once, exhibiting a spectacle which, if the size and color of the bird is taken into account, and the noise and rustling occasioned by the flapping of their wings previous to their rising, is quite unique in its kind. We frequently had from 12 to 15 of them in the boats, and the crews thought nothing of devouring eight roasted swans in a day.

"The animals are the same as in New South Wales—the kangaroo (78), emu, native dog, etc. Fish were abundant, and the Sound swarmed with tiger sharks (79).

"The few natives which we saw were not disposed to behave ill; on the contrary, they seemed much alarmed at first, but soon gained confidence. We gave them some black swans, which they eagerly accepted, and we dressed several of them in the old jackets of our marines. They had, indeed, a most ludicrous appearance, and seemed like men in shackles. It is worthy of remark that these savages have no means of navigation, and rather show a horror of the water. Their arms are the same as those of the natives of New South Wales, their clothing and appearance equally loathsome.

"The advantages which this country holds out to settlers above those in New South Wales —besides the important circumstance of its vicinity to India, the Spice Islands, Java, the Mauritius, and the Cape of Good Hope, and independent of its situation as a place of call for East India and China ships—are, in the first place: The great ease with which a settler can bring his land into cultivation, the forests averaging not more than eight to ten trees per acre;

(78.) Kangaroos, emus, etc., after nearly eighty years' occupation, have naturally been driven further afield, and are still plentiful in some parts of Western Australia. Fish, also, are abundant, although the grounds have been heavily worked by Greeks and Italians for some years past, while the river itself has been almost denuded of its finny inhabitants by the reprehensible allowance of net-fishing. Another factor is the use of trawls for prawn-catching, the constant dragging over the bottom destroying the ground piscine food and disturbing their breeding-grounds. Amended legislation for the preservation of food fishes is urgently needed.

(79.) Dr. Gunther says:—"The tiger shark (*Stegostoma tigrinum*) is one of the commonest and handsomest sharks of the Indian Ocean. The ground color is a brownish yellow, and the whole fish is ornamented with black or brown transverse bands or rounded spots. It is a littoral species, but adult specimens, which are from 10 to 15 feet long, are not rarely met far from land. It is easily recognised by its enormously long blade-like tail, which is half as long as the whole fish." At Sydney the carpet shark, or wobbegong (*Crossorhinus barbatus*), is often erroneously called the tiger shark; and, as the fish are still to be found at Rottnest, it is possible Fraser meant these, and not the true tiger shark of the Indian Ocean. The French also noted the very large number of sharks that hung round their ship off Rottnest in 1801. They are far less plentiful now.

secondly, the facility with which he can bring his produce to market, either by land or water, the coast being easy of access on any part near the river, and no impediments (80) existing in the interior; thirdly, the great abundance of fresh water of the best quality, an advantage which New South Wales, east of the Blue Mountains, does not possess, excepting on the immediate banks of rivers and creeks; fourthly, the great abundance of limestone.

"Ten miles from the entrance of the Swan River, the Moreau of the French branches off to the south, according to the report of the party who went to explore it. It seems of equal extent with the Swan River, and the country on its banks is of the same description.

"The island of Berthollet, distant one mile from Buâche, is a barren inhospitable spot, producing abundance of hares, seals, and mutton birds. Its shores present many tesselated cliffs of limestone, resembling the turrets of a Gothic cathedral. There is no water on this island.

"The island of Buâche is composed principally of low ridges of light sandy loam, traversing the island from north to south, and terminating on the south with high cliffs or banks of sand, the loftiest parts of which are thickly covered with *Cypress (Calytris)*, and the surface, towards the sea, is considerably interrupted by limestone rocks. The soil, though light, appears to me—from the immense thickets of a species of *Solanum* (81) which it produces, and which attains the height of 10 feet—to be capable of producing any description of light garden crops. The interior of these ridges are singularly divided by transverse dykes or banks, forming deep pits, which receive all the water from the ridges, the dykes preventing its escape otherwise than by absorption. The pits are covered with gigantic *Solana*, and a beautiful species of *Brunonia*. Fresh water may be found on each of these islands by digging 2 feet deep. The north side of the island is in many places covered with extensive thickets of arborescent *Metrosideros*, and the soil I found to be of a very fine brown loam, studded with detached blocks of limestone, and susceptible of producing any description of crop. In one of these thickets we sowed various sorts of culinary seeds and introduced several plants of the banana.

(80.) This is not the fact. The sandy nature of the land is a serious impediment in the matter of roads for carriage of produce and goods, and road material in the country generally is absent where agricultural development is practical.

(81.) May be *Solanum simile*.

"The coast towards Point Cockburn is thickly studded with *Cypress*; the soil a light sand. Here we found abundance of fresh water on the beach, as well as in *Cypress* thickets beyond the influence of the sea My observations did not extend beyond Port Cockburn; but, from the appearance of the country, I doubt not its being of the same quality as that already described.

"Between the isles of Berthollet and Buâche is the entrance for ships drawing more than 16 feet of water into Port Cockburn (82). Vessels drawing less than 16 feet can run directly across the Sound, from the entrance of Swan River to Port Cockburn. Vessels of any burthen can proceed up the Sound to the entrance of the river, where there is good anchorage, with plenty of room to beat out should the wind come to blow hard from the north-west.

"It is remarkable that on the shores of the Sound, at the entrance to the river, there is not a perpendicular height of 5 feet from the line of low water to that of vegetation, a proof that there is never any heavy weather in the Sound. There is no surf, and boats may land on any part of the main. On the bar, at the entrance, there is only 1 fathom of water (83), but that is always smooth. Port Cockburn is only distant eight miles from it, where there is room for the largest fleet, with 7 fathoms of water within 20 yards of the shore, and this perfectly land-locked.

"Proceeding from the mouth of the river along Baie Géographe the appearance of the country is particularly pleasing.

"The shore seems well clothed with timber, and the foliage is of the richest green. The observations taken here confirm me in my opinion that the principal part of the timber consists of *Eucalyptus*. I saw no trace of *Banksia* or of *Casuarina*.

"From the shore the country is seen to rise gradually into gentle undulating hills, separated apparently by valleys of considerable size, the whole terminated by a magnificent range of hills, thickly covered with heavy timber extending all along the bay.

"At the head of the bay the feature of the country changes, exhibiting bold hills, with large masses of granite, in many instances jutting into the sea with considerable grandeur. The hills, too, are clear of timber, with the exception of some stunted *Eucalyptus*, and are divided by beautiful winding valleys, in each of which is a small

(82.) Now called Rockingham.

(83.) At a heavy expense this bar has been removed, and a channel of 34 feet provided into the Port of Fremantle.

stream, and a soil of richest loam, throwing up immense quantities of herbaceous plants, amongst which I observed thistles (84) of 11 feet in height. I found the soil, on examination, to exceed 10 feet in depth. On digging the sand on the beach we found abundance of fresh water, while the soil with which the hills are covered is of the finest description to the very summit.

"At Cape Naturaliste the character of the soil continues without any visible change, but in the geological structure there is a very great difference. Here are immense cliffs, presenting at their base large beds of granite and schistose rock, passing alternately into each other, and observing in their dip an angle of 15deg. They were seen occasionally to enclose immense masses of pudding-stone, and an extraordinary aggregate containing petrifactions of bivalve shells and other marine productions, every part of which was covered with minute crystals of lime. Large masses of felspar were seen traversing these beds in various directions, and of various thickness. The granite rock was succeeded by a bed of micaceous schist, in an advanced stage of decomposition, over which were observed several caverns, which were found to contain rock-salt in crystallised masses in large quantities. The rock is decomposed pudding-stone, containing various sorts of granite, the salt having penetrated the most compact parts of the granite. The base of the cavern is a coarse sandstone, the whole covered with limestone. The southern extreme of the cape consists of lofty cliffs, presenting two ranges of superb caverns, the lowest of which we explored (85). The great or outer cavern is about 40 feet high at the entrance, 40 feet in breadth, and about 90 feet in depth. Into this cavern the sea rolls at high water, over immense blocks of granite, in awful grandeur. The stalactites in the cavern are many of them from 20 to 25 feet in length, covered with minute *Cryptogamic* vegetables of fantastic colors and form. The walls are clothed with the same substances, which give to the whole an extraordinary appearance. The second cavern is distinct from the first. The entrance is about 20 feet in height and 20 in breadth, increasing in height and breadth further in. The stalactites and stalagmites are abundant, and of the purest white. The former were observed to exceed 15 feet in length. There was a remarkable circumstance observed at the entrance of the cavern, the stalactites being all bent outwards, as if a gale of wind was perpetually

(84.) At the locality referred to Riédlé, the chief gardener of the French fleet, in 1801, sowed vegetable seeds, and it is probable that here, as at the upper reach of the Swan, some thistle seeds were accidentally introduced.

(85.) Adjoining the marine caverns of Cape Naturaliste is a series of limestone caves, extending about 50 miles to the neighborhood of Cape Hamelin, which have been opened out by the Government. In some respects they rival, if not surpass, the Jenolan Caves of New South Wales.

blowing through the cavern. The three succeeding ones are of minor importance, but all containing stalactites.

"The appearance of the cliffs and caverns from the sea is exceedingly grand. It is impossible to pass along the beach 14 yards without crossing a stream which issues from caves of limestone, and which forms banks of shells, seaweed, stones, and whatever substances may come within their reach, incrusting them in a most beautiful manner.

"Such, indeed, were the attractions of the country that we all felt sorry on leaving it."



DEMONSTRATIONS ON SOME PARASITES OF THE BLOOD.

By Dr. *CLELAND*, Government Bacteriologist.

(Read before the Society, 26 June, 1906.)

When Mr. Woodward, a week ago, asked me to deliver a short paper before you, I chose as its title "A Demonstration of Some Parasites of the Blood," intending to show you, by means of the lantern, various microscopic slides in illustration. Unfortunately, however, I found that the magnification attainable in the instrument fell far short of that –1,000 diameters or thereabouts –which would render the majority of the specimens visible to you. Under these circumstances, and the short time at my disposal, you must excuse the many defects and the discursiveness of this paper.

As the blood is the medium in which the parasites I am dealing with to-night pass most of their existence, I would like to call your attention to some of its properties. You are doubtless familiar with them; but well-known facts, viewed from new aspects, are always interesting. In the first place, the blood is more than a mere fluid — it is, physiologically speaking, a tissue, just as the liver or brain is a tissue; it differs from these merely in containing a greater liquid portion; it consists, as they do, in possessing a cellular part and a fluid one, the plasma; the latter contains food in solution. The cells are of two main types, red and white, and are so numerous that a single drop of blood the size of one c.m.m. contains about five millions of the former and seven thousand of the latter. The red cells carry oxygen incorporated in their substance, and supply it, as their needs require, to the other cells of the body. The white cells, being of several types, have undoubtedly as many functions to perform, some of which we can as yet but guess at, while of others we know nothing. Some of these are scavangers, and in their passage through the vessels pick up indiscriminately any small solid particles they come across, such as finely divided vermilion artificially injected, bacteria harmless or dangerous to the organism at large, etc. In this we see one of the beautiful mechanisms we possess for combating disease; for, if all the harmful germs which enter the blood are thus quickly engulfed and destroyed, the disease they would produce will be arrested at the onset, or at least will remain localised to some part where these cells are few in number.

The blood, and the fluids from it, permeate nearly every tissue of the body, bearing food material to, and carrying effete matter from,

the cells which form these structures and are their living basis. It is natural, then, to expect that in such a medium, rich in food and oxygen, and permeating throughout the organism, parasites of animal and vegetable origin should sometimes be found. Their presence and multiplication depend –first, on the conditions being favorable to their life processes; and, secondly, on the absence of a competent defensive mechanism in the host. Some of the most important animal parasites are protozoa; others belong to a higher order, the worms. The former of these, though placed low in the animal scale, have highly complex life-histories, and, in many instances, pass various phases of these in entirely different hosts, hosts as far removed as man and the mosquito. Hence it follows that I shall deal, not only with the life-histories of the parasites themselves, but also with some traits of the hosts which they infest.

May I first, then, draw your attention to the study of the rat—a most interesting and highly intelligent animal, and one, alas! always with us. He has reached the acme of notoriety of late amongst us in connection with the spread of plague, and for many years has been an object of suspicion in regard to the prevalence in some countries of trichinosis, a disease caused by a minute worm, which is common in the pig, and sometimes, by means of uncooked pork, may cause disease, and even death, in man. Besides these two, his blood harbors a beautiful and delicate protozoan, the *Trypanosoma Lewisi*, closely resembling the organism of sleeping sickness in man; and we have recently, in Perth, in one rat found another protozoan inhabiting the white cells of the blood, to which special interest attaches, as it has only been seen once before, and that was last year, in the Soudan.

Mr. Woodward will tell you that there are eleven species of the genus *Mus*, to which the rats and mice belong, to be found in this State. I have some specimens here to show you. In spite of frequent opprobrium cast at them, they are, you see, beautiful objects and far from repulsive. Their scale of intelligence, too, is high, which is undoubtedly partly due to their intimate association with man and the cleverness necessarily evolved to escape his schemes for their destruction; for, by natural selection, the foolish ones and incapables would succumb, while the mentally endowed and prudent would escape, to hand on to their offspring the excellent qualities they themselves possessed. It has often seemed to me that, had not man attained the high dignity he has reached, or should he cease to be in this world, his place might eventually be taken by the rats, or even by the still lower ants. The evolution of speech, and with it the communication and storing up, from one generation to another, of the results of experience was the crowning effort that raised man from the ranks of the beasts to a place—I may say with all reverence —a little lower than the angels. Another great advantage he possessed was that of hands; but monkeys possess such, and even

our friends—or shall I say enemies—the rats have excellent ones. To see one of my laboratory rats holding up in his two front paws a biscuit or a piece of bread, as we would a slice of watermelon, has often struck visitors with astonishment and delight. Their cleanliness, too, is great, and any idle moments are devoted to arranging their fur and washing their ears and head as we do under a shower. They have their points of humanity, too, and a touching incident is told of a horde of migrating rats. The last to emerge was an old, decrepid and blind rat, filially attended by one of a younger generation!

But, in spite of its many virtues, the rat, I am sorry to say, notwithstanding strenuous efforts to the contrary, is frequently infested with fleas—and, alas! this is still another resemblance to some beings of a higher estate! Four species of these fleas are known in Australia, and all will, probably, when hungry, bite man. It is, in great part, by their means that the various blood parasites of the rat pass from one animal to another, and even, in some instances to man. Take, for instance, the trypanosome, a protozoal parasite with a complicated life-history. You see, from the photograph, that it possesses a body, a long flagellum for propulsion, a nucleus, and an undulating membrane. Though a single cell or individual organic unit, allied to the cells or units, each an individual entity and living being, that comprise the tissues that build up our body, it is a very complicated one. Part of its time is spent in the blood of the rat where it grows and multiplies, and from its small size permeates everywhere But, were this its sole life-history, when its host died its progeny would cease to exist also; so another factor steps in, that of blood-sucking insects—fleas, or possibly lice. These ingest blood containing trypanosomes, which probably undergo another complicated phase of their life-history in the new host, mature, and are injected with the secretion when next the original host is bitten, and so the cycle is completed. This trypanosome of rats, the *T. Lewisi*, is probably only rarely fatal to rats, even though present in vast numbers. It is frequently found in the Perth rats, and was first described many years ago. It was looked on more as a curiosity, however, until the important discovery of an almost identical trypanosome in sleeping sickness in man—a disease now raging on the Congo, and already responsible for almost a million deaths. Several Europeans, whose business or humanity has taken them to these parts, have fallen victims to it, and its sway is extending. The intermediate host, in this instance, is a tse-tse fly; it bites an infected man, the parasite matures in its body, and is then injected into a new individual with fatal results. Where the fly does not exist the disease also is non-existent. The famous tse-tse fly disease of cattle is due to a similar organism propagated by a similar fly.

I have already referred incidentally to another protozoal parasite of the rat, the *Leucocytozoon*, a *Hæmogregarine* Having only been seen

twice, little is, as yet, known of its life-history. It probably enters the blood through the bite of some insect, appears first as a minute vermicule, and then enters into the body of a white cell, where it grows. It illustrates the old distich of Dean Swift :—

> " Big fleas have little fleas upon their backs to bite 'em,
> And little fleas have lesser fleas, and so *ad finitum*."

On account of the presence of plague amongst us, you all, and justly so, doubtless regard the rat with dread. In the septicæmic form of this disease, which is common in the rat, and also occurs in man, as some late sad examples illustrate, the blood may swarm with the bacilli of plague, so that plague may well come under the catalogue of a parasitic blood disease, if the term is used in an elastic sense. Plague occurs as an epizootic in rodents, and it is by these means, and these alone, that its spread, in Australia at least, is due. Other animals, such as kangaroos and guinea pigs, when exposed to infection from them, may succumb as well as men. Its association with rats was known even in Biblical times, as can be gathered from the Old Testament. Browning's poem on the " Pied Piper of Hamelin" is, further, I believe, based on a tradition, handed down from the middle ages, of an epidemic that chiefly affected children, as did some of these early epidemics. You remember how the rats swarmed in the old German town ; how the mythical piper came and charmed them away, for they died of the plague ; and how the children, too, disappeared, all save one little crippled fellow, for they also succumbed to the malady. The " Piper " was the " Angel of Death," and the little children, in their suffering, danced to his music and followed him eagerly. Rats and the plague remind one of the grim story of the " Wandering Jew," cursed to wander over the face of the earth, and never rest, for his inhumanity to Christ on his way to Calvary, and leaving ever behind him the seeds of pestilence and famine ; but the seeds were those of cholera, and not of plague.

But, passing now to the proper study of mankind to man—he is also grievously afflicted by certain blood parasites of so-called low organisation. The history of malaria reads like a romance—a romance not of the time of King Arthur but of to-day, for the discoverer of the *rôle* of the mosquito, Major Ross, is still amongst us and in the seat of honor. The parasite, as found in man, inhabits the red cells of the blood ; and, by the destruction of these important carriers of oxygen, saps the vitality, and by some subtle poison it produces sets up the symptoms of ague. Such contaminated blood, ingested by a mosquito, gives the parasite the chance of entry into its intermediate host. In the mosquito's stomach it grows and multiplies, passes thence to the poison gland (one of the salivary glands), and so is injected at the next bite into another human victim. It is only one genus of mosquitoes, the *Anopheles*, a form present amongst us, that is thus capable of acting as an intermediate host ;

and it is, further, only the females of this and other mosquitoes that feed on blood at all, the only food of the males, and the usual nutriment of the females, being vegetable juices. As, however, blood is necessary for the proper maturation of the eggs, the female adopts the eccentric habit of biting blood-containing animals. Probably, at one time, the mosquito was an entirely blood-sucking insect; but the danger attached to this method of feeding, and perhaps its frequent scarcity, have, I am glad to say, turned their attention in some degree elsewhere. Imagine the bites of mosquitoes doubled or trebled and pity paleolithic man! I show you some of the parts of the mosquito. Note the lancets enclosed in their sheath, which latter, as the former pass deeper, is bent back to an acute angle.

At this point a few remarks on mosquitoes may not be inopportune. They belong to the *Diptera*, or two-winged insects, the second pair of wings of other insects being reduced to two small appendages, the halteres, one on each side, behind the first pair. Thanks to recent researches, set going by the discovery of the important *rôle* played by mosquitoes in producing disease, this group has received much attention of late, and several thousand species are now described, and new ones are being added day by day. In Australia, only, about thirty species have been so far recorded, one of which has the almost unique privilege, amongst mosquitoes, of living in salt water during its larval stage.

The life-history of a mosquito is a complicated one. The female, after her meal of blood, flies to a collection of water, which must not be stagnant, and deposits her eggs, singly or in raft-shaped masses. These hatch into queer-shaped larvæ, which feed and grow in the water, rising frequently to the surface to obtain their supply of oxygen. I have here some living specimens to show you. Now is the time to destroy them, for the future pest is easy of access and the individuals are collected together in small areas. A few drops of some oily fluid, such as kerosene, which will diffuse over the surface of the liquid, by forming an impermeable scum, through which their air-breathing syphons cannot penetrate, will suffocate them by cutting off the oxygen supply—just as we would suffocate if a tarpaulin were spread over the sea, while we were bathing, so that our heads could not emerge from the water. Great success has attended measures such as these, combined with drainage of pools, the destruction of all receptacles, such as old tins, in which water can collect, and the covering in of rain-water tanks and water-butts, which are favorite sites for the larvæ. In parts of India the incidence of malaria has been wonderfully reduced, and the

"Bight of Benin,
Where, of one that comes out a hundred go in,"

with Lagos and the Guinea Coast around it, is losing some of its terrors in consequence. Sir William McGregor, Governor of Lagos, I am proud to say, a member of my own profession, has done much

to increase in this way the salubrity of his colony. The mortality in these West Coast of Africa places has been, I may say, almost entirely due to malaria—and whisky.

After a few short weeks as a larva, the young mosquito passes for three or four days into a hunchbacked pupa, which breathes but does not feed, while the wonderful kaleidoscopic matamorphosis, which will produce the imago or perfect insect, is going on in its body. I use the term "kaleidoscopic" with reason, for the tissues of the larva are converted into a mass of cells, from which the imago is built up afresh, just as the pieces of glass in a kaleidoscope form a jumbled mass in passing from one picture to another. The appearance of the pupa at this stage is grotesque, and its peculiar jerking movements equally so, and quite different from those of the larva.

But anon comes the eventful day when, as Tennyson said of the dragonfly—

> "An inner impulse rends the veil
> Of his old husk, from head to tail,
> Shine forth clear plates of sapphire mail."

On some clear and sunny day, perhaps, or on some still summery evening, the back of the pupa case bursts asunder, and from the open husk steps forth the perfect insect, poising itself for some short time upon its cast-off tenement ere winging its way to "fresh fields and pastures new." If at this time the surface of the water is rippled, if rain descends, the doomed insect's life is cut off before its aerial course has even begun. Hence you see at once why open and wide expanses of water are not breeding grounds for the mosquito, while sequestered and sheltered pools or collections of water in old tins are.

The habits of mosquitoes are as various as their species. Some bite by day and some by night, aud others during both. In one particular place, I thought they had a curfew system, founded by by some William the Conqueror among them, for all, as with one accord, retired to bed or rest and meditation at 8 o'clock in the evening. Others become, in a way, domesticated; and, while carefully refraining from annoying the inhabitants of their own particular house, pay a too flattering attention to visitors. At my home in Adelaide, for instance, our own mosquitoes, while leaving us severely alone, render a friend's life miserable, though he lives but a mile or so away; while his mosquitoes never worry him, but have a wonderful *penchant* for me! This suggests the possibility of rendering one's house burglar-proof by fostering this excellent trait in the mosquitoes. Imagine a burglar effecting an entrance amid the harassing attentions of a horde of mosquitoes and you must feign pity the poor man!

I have already referred to the *Anopheles* as the malaria-carrying mosquito. She has certain traits which mark her out, and by which

she may be known. When biting or resting she "stands on her head," as it were that is, proboscis and body form one straight line ; while the common *Culex* and its congeners have the proboscis and body joining at an angle, so as to look hunchbacked. Further, the larva of the *Anopheles* lies flat along the surface of the water, while a *Culicine* larva, as you see, hangs with head down. The *Anopheles* are, further, not domestic as regards inhabiting houses, and only fly in during the night to bite, and with dawn return to their forest haunts.

There are two other diseases communicated to man by the mosquito. One of these is yellow fever—a disease, I am glad to say, not present among us, though close allies of the mosquito *(Stegomia fasciata)* which transmit it are. Though the germs of this disease have never been seen, for they are as yet ultramicroscopic, and so small that they will even pass through the pores of a porcelain filter, there is little doubt but that they are protozoal in nature. The *rôle* of the mosquito in its spread is, at any rate, undoubted. For instance, some of the members of an American Commission on the disease slept in the unwashed bed of a patient who had died of yellow fever, wore his clothes, soiled as they were, and continued this for several days. They did not contract the disease, so contact of this kind undoubtedly was not a factor, in spite of popular ideas in its favor. Then they allowed themselves to be bitten by mosquitoes which had fed on yellow-fever patients, after having allowed any parasites ingested by these insects to mature for a few days in their intermediate host All so bitten fell ill, and some died—true martyrs to science—while control cases bitten by similar mosquitoes which had not so feasted escaped. Olive Schreimer says, in "Waldo's Dream," as doubtless these men may have said :—"By the steps that I have cut they will climb, by the stairs I have made they will mount ; and no one liveth to himself and no one dieth to himself." It forms a noble epitaph, and they were noble men.

The other mosquito-produced disease is that caused by *Filaria*, of which several species in the embryonic condition have been met with in the blood of man. These are minute worms, whose parents reside in the small vessels of various parts, discharging their young thence into the general circulation. One of the symptoms is elephantiasis, an enormous development of one or other limb. This disease occurs in Queensland, and possibly in our own North-West. The honor of discovering the parent worm, which for long eluded detection, is due to the late Dr. Bancroft, of Brisbane, and is known as *Filaria Bancrofti*. The mosquito at work is the *Culex*, common here as elsewhere in the world. It simply awaits the importation of cases in man for the disease to appear amongst us.

It may be mentioned, in passing, that dengue fever, so common in epidemic form in Queensland, has recently come under suspicion as a possible mosquito-borne disease. Dr. Peter Bancroft's researches

in Brisbane have not yet confirmed this, however. The term "dengue" is a Spanish word for "dandy," and has been given to the fever on account of the muscular pain that movement causes giving a dandified stiff appearance to the gait of the patient.

Certain ticks act further as intermediate hosts in carrying various diseases to man and animals. Livingstone noted a tick (*Argas* or *Ornithodorus moubata)* in one of his expeditions, the bite of which produced a fever in man, and this has recently been found to be due to a delicate spiral organism (a *spirillum*), which is injected into the blood when the tick bites. Relapsing fever, which at one time was a scourge in the poor parts of British towns, is due to a possibly identical organism; but here the intermediate host is the detestable bed-bug. As a parenthesis, it may be stated that the word "bug" had an interesting origin—it is really "be ogan," an old Anglo-Saxon word, I believe, meaning a ghost or spirit; it occurs with this interpretation in the well-known "Bug-Bible," where the text "The arrow that flieth by day or the pestilence by night" is translated "bug by night." The creature was introduced into England, probably from the Continent, somewhere about the year 1634, and first attacked certain ladies of fashion in whose baggage it had doubtless come over. The weals raised by its bites, and the retiring habits of the animal, gave birth to the idea that "beogs," or spirits, were at work!

The tick fever of cattle will occur to everyone as an example of a disease of great economic interest, due to a blood-parasite. The protozoa occur as minute paired bodies in the red cells, which they finally destroy. A tick, after feeding on the blood of an infected animal, drops off gorged to lay its eggs in the grass, and with the eggs the parasites are handed on to undergo a phase of their life-history in the young generation, and so reach again the original host, cattle.

Ticks belong to the *Ixodes*, closely allied to the spiders, and constitute one of the groups of *Arthropods*. The larva, emerging from the egg, is six-limbed, while the adult animal has eight legs. The young larvæ of the cattle tick climb to the top of blades of grass, and there patiently wait till their victim passes by, when they seize hold with their claws of the hairs of the cattle, and so reach the animal's skin, to which they fasten themselves.

Numerous other diseases due to blood-parasites are known, such as surra, a trypanosomiasis, affecting horses and camels (I have reason to suspect its occasional presence in camels in West Australia); Rocky Mountains fever, a disease like tick fever of cattle, but affecting man; various cattle and horse diseases in South Africa; filaria of dogs, in which huge worms form a mass in the heart blood; tick fever in fowls, which is common in our midst, and which we owe to America; and many others.

Let me conclude by saying that the study of these very interesting organisms is proceeding by leaps and bounds. Though the vineyard perhaps is great, and the laborers few, those few are energetic and willing, and, as you have seen, have some of them laid down their lives in the task. It is to those who work in the garden of Nature, like those who go down to the sea in ships, that the marvels of the Creator appear, and the lines of Longfellow to the great naturalist Agassiz have a special meaning :—

And Nature, the old nurse took
The child upon her knee,
Saying, "Here is a story-book
Thy father hath written for thee."

"Come, wander with me," she said,
"Into regions yet untrod,
And learn what is still unread
In the manuscripts of God."

So he wandered away and away,
With Nature, the dear old nurse,
Who sang to him, night and day,
The Rhymes of the Universe.

It is they, moreover, who know that—

Every common bush is afire with God,
But only he who sees takes off his shoes ;
The rest stand round and pluck blackberries,
And daub their natural faces, unaware,
More and more from the first similitude.

